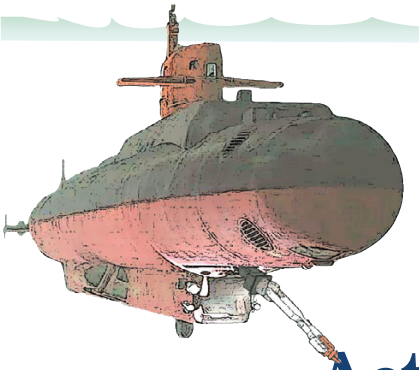


Activity #5
Manta Mysteries

Cool Fact

Manta rays were named for their wide, flat bodies. Manta means "blanket" in Spanish.

© Kaile Tsapis

Cool Words

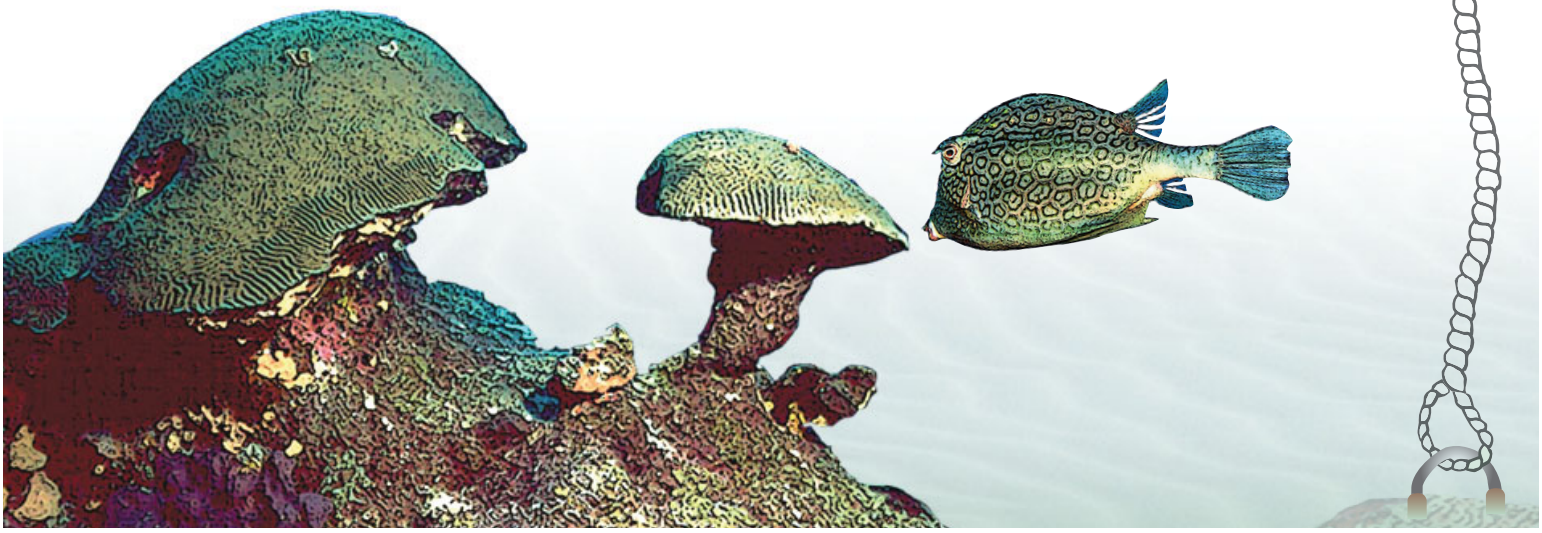
Cartilage
Tough and flexible skeletal tissue

Zooplankton
Tiny animals that drift in the water

Cephalic fins
The pair of fins on either side of a manta ray's head

Acoustic tag
A small device that sends out sound waves

Acoustic receiver
A device that gathers sound wave data



Manta rays are large, graceful animals that live in warm ocean waters. Like sharks, they have no bones. Their skeleton is made of a tough, flexible tissue called **cartilage** (KAR tuh lihj)—the same material that's in the tip of your nose. Manta rays have flat, wing-like fins on each side of their body. They use these fins to fly through the water.

Adult manta rays can be more than 20 ft (6 m) across. Although mantas are very large, their food is very small. Mantas eat **zooplankton** (ZOH plank tun), which are tiny animals that drift in the water. As a manta swims, it uses the specialized **cephalic** (seh FA lihk) **fins** on either side of its head to help direct food and water into its mouth.

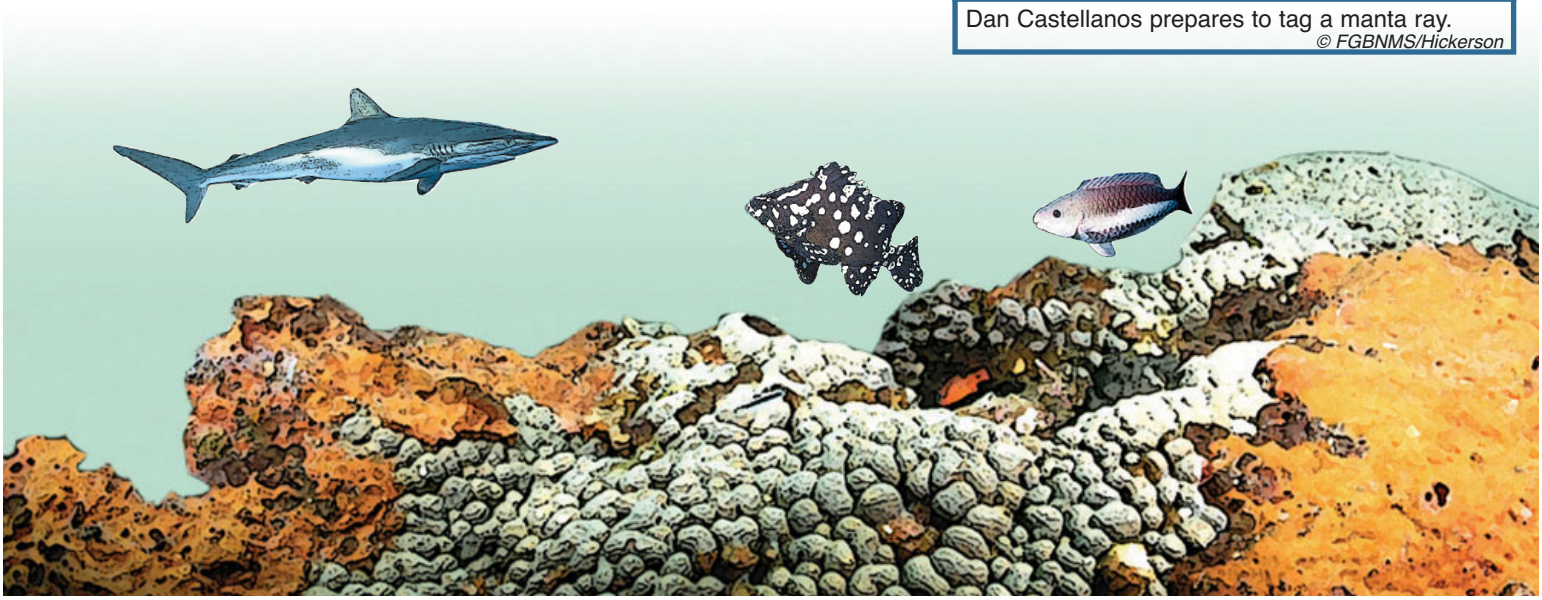
Researchers at the Flower Garden Banks have been interested in manta rays for a long time. They know basic things such as how mantas look and what mantas eat. But they have many unanswered questions. Do any mantas live at the Flower Garden Banks year-round? How far do mantas travel in their lifetime? How many mantas live in the world's oceans?

To answer these questions, researchers need to be able to identify individual manta rays. Mantas look similar from above. But every manta has a one-of-a-kind spot pattern on its belly. For several years, divers at the Flower Garden Banks have been photographing manta rays from below. All of the photographs go into a catalog. The catalog currently includes more than 25 different mantas.

Photographs help researchers identify manta rays. But some researchers want to do more than just identify the mantas. Dr. Rachel Graham and Dan Castellanos want to know how and why mantas move from place to place. They started a research project in 2006 to investigate the movement patterns of mantas at the Flower Garden Banks.

Graham and Castellanos went on three research cruises to the Flower Garden Banks between February and October 2006. They looked for mantas during each cruise. Castellanos used a long pole and a plastic dart to insert an **acoustic** (uh KOO stihk) **tag** into six of the mantas that they found. An acoustic tag is a small device that sends out sound waves. Each tag sends out a distinct pattern of sound waves.

Dan Castellanos prepares to tag a manta ray.
© FGBNMS/Hickerson

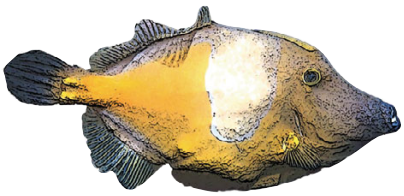


Graham and Castellanos also set up three **acoustic receivers**. An acoustic receiver gathers sound wave data. When a tagged manta swims close to an acoustic receiver, the receiver records the identity of the manta, the date, the time, and other data. The three acoustic receivers are at the East Flower Garden Bank, the West Flower Garden Bank, and Stetson Bank. Graham and Castellanos hope to set up more receivers in the future.

A tagged manta ray swims near the acoustic receiver at the East Flower Garden Bank.
© FGBNMS/Hickerson

This research is still new. But there are already some important findings. A manta ray that was tagged at the East Bank was found to have visited the West Bank, which is 12 mi (19 km) away. This shows that the two banks are connected by more than just water. Living things that travel between the two banks might travel to other areas, too. Following mantas could help scientists learn more about connections between the Flower Garden Banks and the rest of the Gulf.

During the Secrets of the Gulf expedition, Graham and Castellanos gathered new data on the movements of the tagged mantas. They also looked for more mantas to tag. They hope that their research continues to unlock some of the unsolved mysteries of manta rays.



Now that you know the basics of manta ray research at the Flower Garden Banks, follow the steps on the next page to try your hand at identifying mantas!

Activity

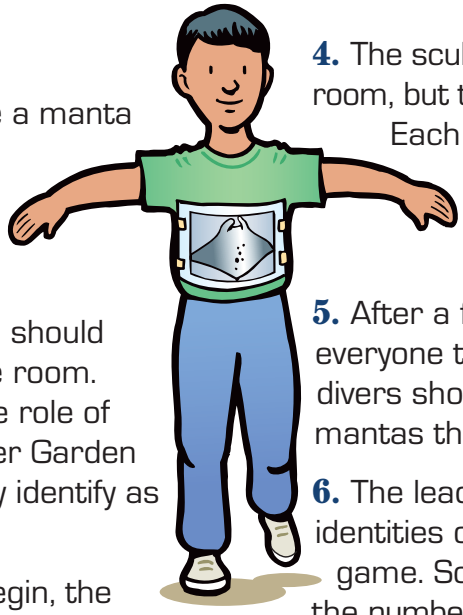
In this activity, you will play a game to practice identifying manta rays.

Materials

- Manta Ray Photo Catalog
- manta ray spot patterns
- masking tape
- notebook
- pencil

Ready to Begin?

Steps



1. Six participants should tape a manta ray spot pattern to their shirt. These participants will play the role of manta rays near the East Flower Garden Bank.

2. The rest of the participants should choose a place to stand in the room. These participants will play the role of scuba divers at the East Flower Garden Bank. Their goal is to correctly identify as many manta rays as possible.

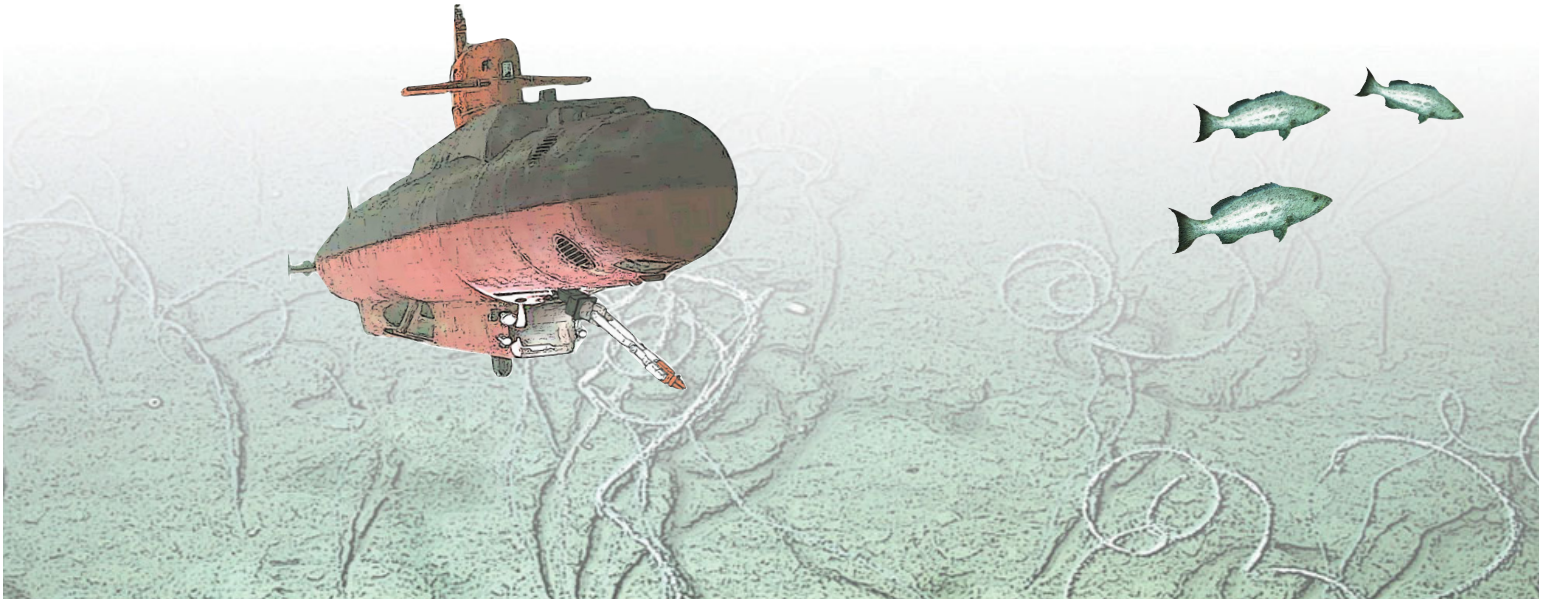
3. When the leader says to begin, the manta rays should begin to walk around the room. They can walk in a straight line, spin in circles, or stand still. They should flap their arms back and forth in a wing-like motion as they walk.

4. The scuba divers can also walk around the room, but they must not touch the mantas. Each scuba diver should use the Manta Ray Photo Catalog to identify as many of the manta rays as possible.

5. After a few minutes, the leader will tell everyone to stop. At this point, the scuba divers should make a final list of the mantas that they identified.

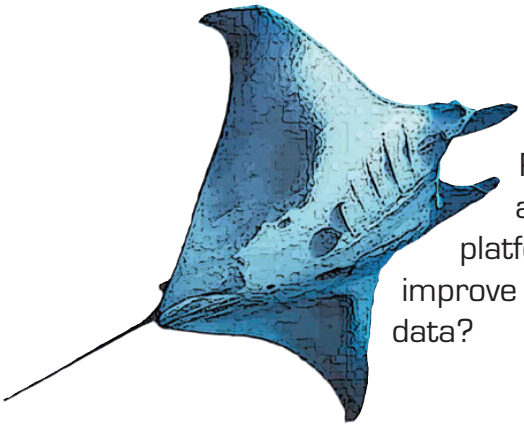
6. The leader will then reveal the correct identities of the mantas that were in the game. Scuba divers should keep track of the number of mantas that they identified correctly.

7. Play the game at least twice before discussing the results.



Taking It Further Activity: Add Acoustic Receivers

Play the game again, but this time use two separate playing areas to represent the East Flower Garden Bank and the West Flower Garden Bank. The manta rays can go between the banks, but the scuba divers must stay at a single bank. One participant at each bank should play the role of an acoustic receiver. The acoustic receiver should have a notebook and a pencil. Whenever a manta ray arrives at or departs from a bank, it must check in with the acoustic receiver. The acoustic receiver must record the name of the manta and the time of its arrival or departure. The scuba divers should also try to record what time it is when they identify a manta ray. After playing one or two rounds of the game in this way, discuss how it is different from the original version of the game. What new information is gathered in this version? What information about the movements of the manta rays is still unknown?

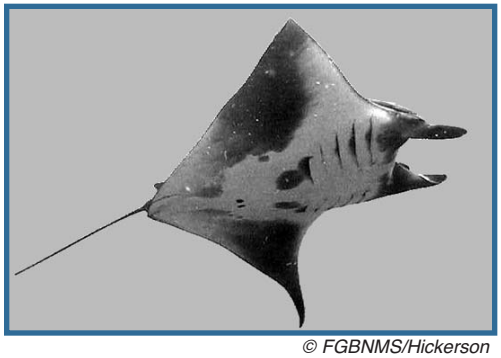


Think About It

Rachel Graham and Dan Castellanos hope to add more acoustic receivers to other banks as well as to oil and gas platforms. How will having more receivers help the researchers improve their data? How else could the researchers improve their data?

Manta Ray Photo Catalog

Manta 1



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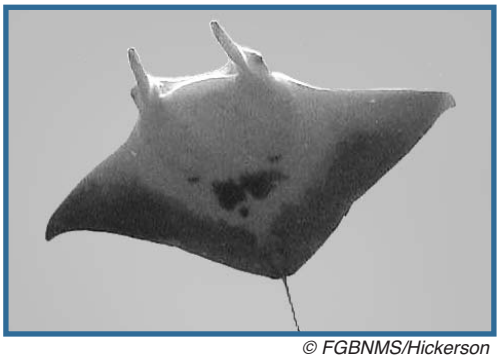
Manta 2



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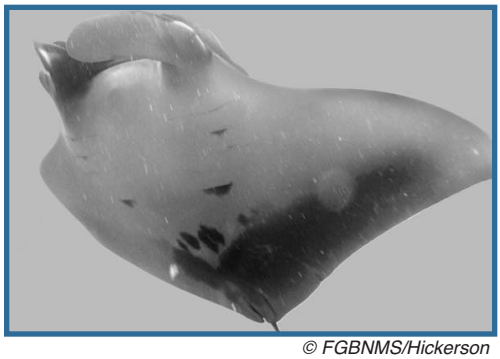
Manta 3



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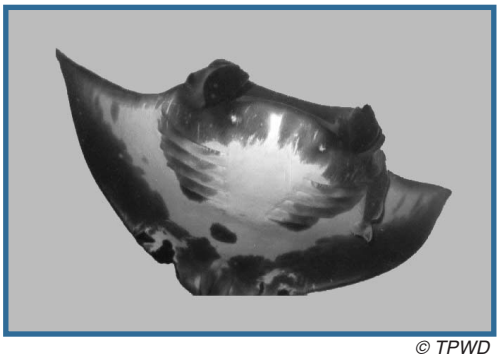
Manta 4



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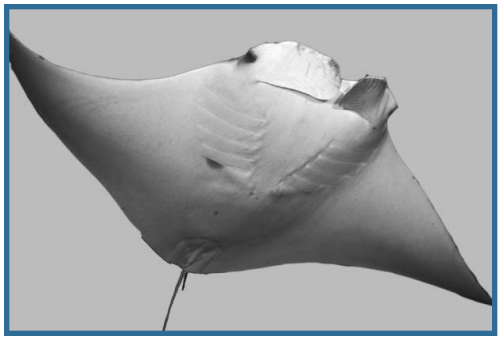
Manta 5



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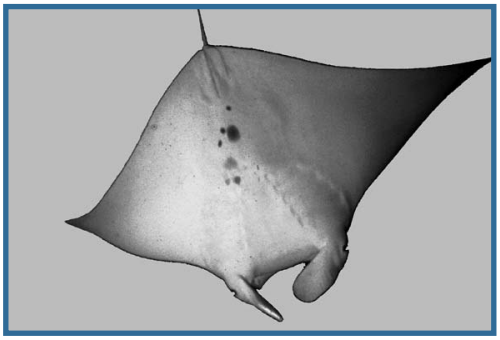
Manta 6



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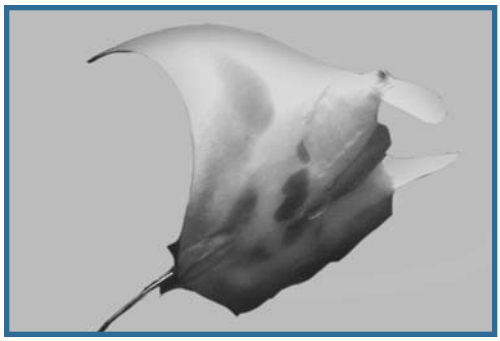
Manta 7



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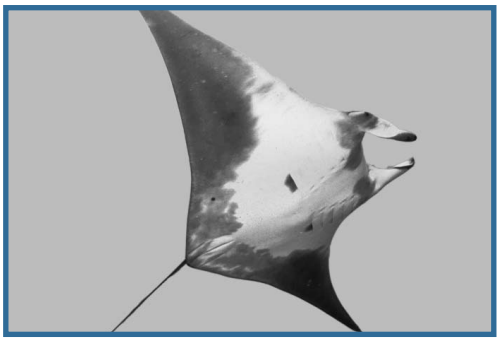
Manta 8



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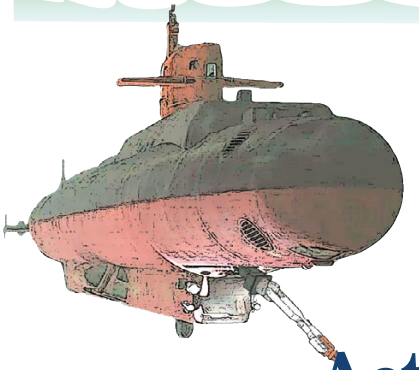


Activity #5
Manta Mysteries

Summary

In this activity, participants play a game to simulate the identification of manta rays in the field.

Difficulty: Easy to Medium

Suggested Group Size: 12 to 25

Time: 45 minutes

Goals

Participants will:

A. learn how photographs help researchers identify manta rays
B. describe how acoustic tagging is being used to investigate manta ray movement patterns at the Flower Garden Banks
C. play a game to simulate the identification of manta rays in the field

Materials

For each "scuba diver" participant:

- Manta Ray Photo Catalog
- notebook
- pencil

For each "manta ray" participant:

- manta ray spot pattern
- masking tape

For the leader:

- Manta Ray Spot Patterns 1–8
- scissors
- 8 pieces of cardstock, 8.5-in. x 11-in.
- glue stick
- Manta Ray Spot Patterns Answer Key

For the Taking It Further Activity:

- 2 chairs
- clock or stopwatches

Cool Words

Cartilage
Tough and flexible skeletal tissue

Zooplankton
Tiny animals that drift in the water

Cephalic fins
The pair of fins on either side of a manta ray's head

Acoustic tag
A small device that sends out sound waves

Acoustic receiver
A device that gathers sound wave data

Think About It

Rachel Graham and Dan Castellanos hope to add more acoustic receivers to other banks as well as to oil and gas platforms. How will having more receivers help the researchers improve their data? How else could the researchers improve their data? *Having more acoustic receivers will help Graham and Castellanos keep track of the mantas at more locations over a greater area. However, they will still be unable to follow the mantas at all times, as the mantas cannot be tracked when they are not close to a receiver. (Graham and Castellanos intended to test the range of the receivers at the Flower Garden Banks in 2006, but they were unable to do so due to strong currents and lack of time. They know that the typical range of similar receivers under similar conditions in Belize is about 1,650 ft (500 m) in all directions.)*

In order to get a more comprehensive look at the movement patterns of mantas in the Flower Garden Banks area, Graham and Castellanos could tag more mantas. They could also use another kind of tagging system, such as satellite tags. One type of satellite tag records temperature, depth, and light level data over a certain period of time. After data collection is complete, the tag releases from the manta and floats to the surface to transmit the data. A satellite orbiting Earth receives the data and sends them to researchers via e-mail. The researchers can use the data to estimate the movements of the manta during the time it was wearing the tag. Graham and Castellanos plan to tag more mantas. They also might explore satellite tagging in the future.

Extra Background

You might want to share with participants that Rachel Graham and Dan Castellanos try to minimize any pain that mantas might feel during the tagging procedure. Mantas tend to react when they are tagged, but each one reacts differently. Some swim away quickly as soon as they are tagged. Others start to swim away but then come right back to hang out with the scuba divers in the water. Graham and Castellanos use plastic darts when they tag mantas because they believe that they are less painful to the mantas than metal darts. The darts are only a couple inches long and a couple centimeters wide. When Graham and Castellanos tag mantas, they approach the animals in their blind spot. This way the mantas do not see them and do not associate humans with the tagging event. In general, mantas seem more startled or surprised than anything else when they are tagged.

The acoustic tags and the acoustic receivers are battery operated. The batteries in the acoustic tags are designed to last at least three years. When the batteries in a tag die, the tag no longer transmits sound waves. Eventually, the tag falls off the manta. The batteries in the acoustic receivers last about 15 months. Graham and Castellanos change the batteries in the receivers every time they go back to the Flower Garden Banks, or at least every six months.

Set-Up

Make a copy of the Manta Ray Photo Catalog for each participant.

Prepare the manta ray spot patterns prior to beginning the activity. First cut out each spot pattern. Then use a glue stick to mount each pattern on an 8.5-in. x 11-in. piece of cardstock. The cardstock will give the patterns more stability. If possible, laminate the cardstock and patterns to give them even more stability. You might want to write a small note on the back of each card to help you remember which manta is which (use the information on the Manta Ray Spot Patterns Answer Key).

This activity is best done in a large open space such as a gym.

Working With Groups

This activity works best in a large group of at least 12 participants.

Activity Notes

Split the participants into two groups: manta rays and scuba divers. For the first round of the game, six participants should be manta rays and the rest of the participants should be scuba divers. In this round, use only Manta Ray Spot Patterns 1–6. Have each of the manta rays use masking tape to affix one of the manta ray spot patterns to the front of their shirt, over their belly.

After the manta rays are ready, distribute a copy of the Manta Ray Photo Catalog to each scuba diver. Also make sure that the scuba divers have notebooks and pencils so that they can record their manta ray identifications.

Have the manta rays stand with their spot patterns facing a wall while the scuba divers spread out in the room. After all of the scuba divers are in place, announce that it is time to begin and tell the manta rays to move away from the wall. Remind all participants to walk at all times during the game.

Depending on the size of the group, each round of the game should last between one and five minutes. Allow enough time so that each scuba diver has a chance to correctly identify at least a few mantas. Do not allow so much time that all of the scuba divers are able to correctly identify all of the manta rays.

After the first round of the game is over, have participants switch roles. For the second round of the game:

- If you have fewer than 16 participants, have half of the participants be manta rays and have the other half be scuba divers.
- If you have 16 or more participants, have eight of the participants be manta rays and have the rest be scuba divers.

If you wish, include Manta Ray Spot Patterns 7 and 8 in the second round. Note that these two spot patterns do not match up to any of the mantas in the Manta Ray Photo Catalog. They represent manta rays that have not yet been identified. Do not share this information with participants—let them figure out how to deal with the mystery mantas during the course of the game.

Also note that Manta 3 and Manta 7 from the Manta Ray Photo Catalog do not appear on any of the Manta Ray Spot Pattern sheets. They represent mantas that were identified previously at the Flower Garden Banks but are not currently in the area.

After participants have played two rounds of the game (or more, if desired), have them discuss the experience as a group. If you chose to include Manta Ray Spot Patterns 7 and 8, discuss with participants how they handled seeing mantas that were not included in the Manta Ray Photo Catalog. Some participants might have tried to force a fit between the mystery mantas and the mantas in the catalog. Others might have decided to not identify those mantas. Still others might have tried to sketch the spot patterns of the mantas in order to establish them as new identifications.

Optional: Have participants do the activity again, but this time do not allow the scuba divers to carry the Manta Ray Photo Catalog with them. Instead, have them carry only their notebooks and pencils. Have them sketch the spot patterns of any mantas that they see. Then, after the game is over, have them try to match up their sketches to the mantas in the photo catalog. Have them discuss whether it was easier or harder to identify the mantas this way. In reality, scuba divers do not usually bring a photo catalog into the water with them. Instead, they sketch or photograph the mantas that they see. Only later do they compare the images to the mantas in a photo catalog.

Taking It Further Activity

If possible, set up two playing areas at least 30 ft (9 m) apart. Have one participant in each area play the role of an acoustic receiver. Each acoustic receiver should sit in a chair with a notebook and a pencil. If there is no visible clock in the playing area, supply each acoustic receiver with a clock or stopwatch.

Remind the manta rays that in this version of the game, they must check in with the acoustic receiver whenever they arrive at or depart from a bank. Either allow the manta rays to decide on their own how often to move between the banks, or assign them movement patterns (e.g., two mantas stay at the East Bank; two mantas stay at the West Bank; and two mantas travel between the banks). After playing one or two rounds of the game in this way, ask participants to share how this version differs from the original version of the game. Participants should explain that this version includes information about time. Knowing how long a manta was within range of an acoustic receiver is potentially more useful than knowing only that the manta was identified as being in the area. Even in this version of the game, some information about the movements of the mantas is still unknown. For example, no data exist for the time periods when the mantas are between the banks.

Discussion Questions

How are photographs helpful to researchers in identifying manta rays? *(The belly of every manta ray has a unique spot pattern. Divers take photographs of these spot patterns. The photographs are then put into a catalog that researchers can use to identify manta rays in the field.)*

What is one of the goals of the manta ray research project that Rachel Graham and Dan Castellanos began in 2006? *(One of the goals of the manta ray research project is to learn more about the movement patterns of manta rays at the Flower Garden Banks.)*

What are some advantages of using acoustic tags to track manta rays? What are some disadvantages? *(One advantage is that acoustic receivers can gather data about manta rays even when no people are present in the water. Also, the manta rays do not have to be in a particular position—such as belly-down—for the acoustic receivers to identify them. Finally, the acoustic receivers can track the movements of the mantas over time. A disadvantage is that the acoustic receivers cannot track all manta rays—they can track only manta rays that carry acoustic tags. Also, there are a limited number of acoustic receivers, and each one has a limited range; the receivers cannot track mantas in all places at all times.)*

One of the manta rays that Graham and Castellanos tagged at the East Flower Garden Bank was later found to have visited the West Flower Garden Bank. Why is this an important finding? *(This is an important finding because it shows that the East Bank and West Bank are connected. Scientists know that the banks are connected by water, but they did not have any prior evidence of a single large fish visiting both banks. If one manta was observed to do this, maybe other mantas and even other types of marine life also move between the banks. It is possible that manta rays seen at the Flower Garden Banks travel to other banks, too. They might also travel to oil and gas platforms. Researchers are very interested in learning more about how different areas of the Gulf are connected to one another. Understanding these connections can help scientists better manage and conserve the resources of the entire Gulf region.)*

As a scuba diver, what was the easiest part of this game? What was the hardest part? *(Answers will vary. Participants might say that the easiest part was identifying a manta ray when its belly was facing them. They might say that the hardest part was figuring out what to do when they saw a manta that was not present in the Manta Ray Photo Catalog.)*

Additional Information

Books

Sharks and Rays of the World, by Doug Perrine.

Sharks, Skates, and Rays of the Gulf of Mexico: A Field Guide, by Glenn R. Parsons.

Videos

Manta Ray Videos (online), produced by Manta Pacific Research Foundation.

Web Sites

Flower Garden Banks National Marine Sanctuary Web site

Immersion Presents Web site

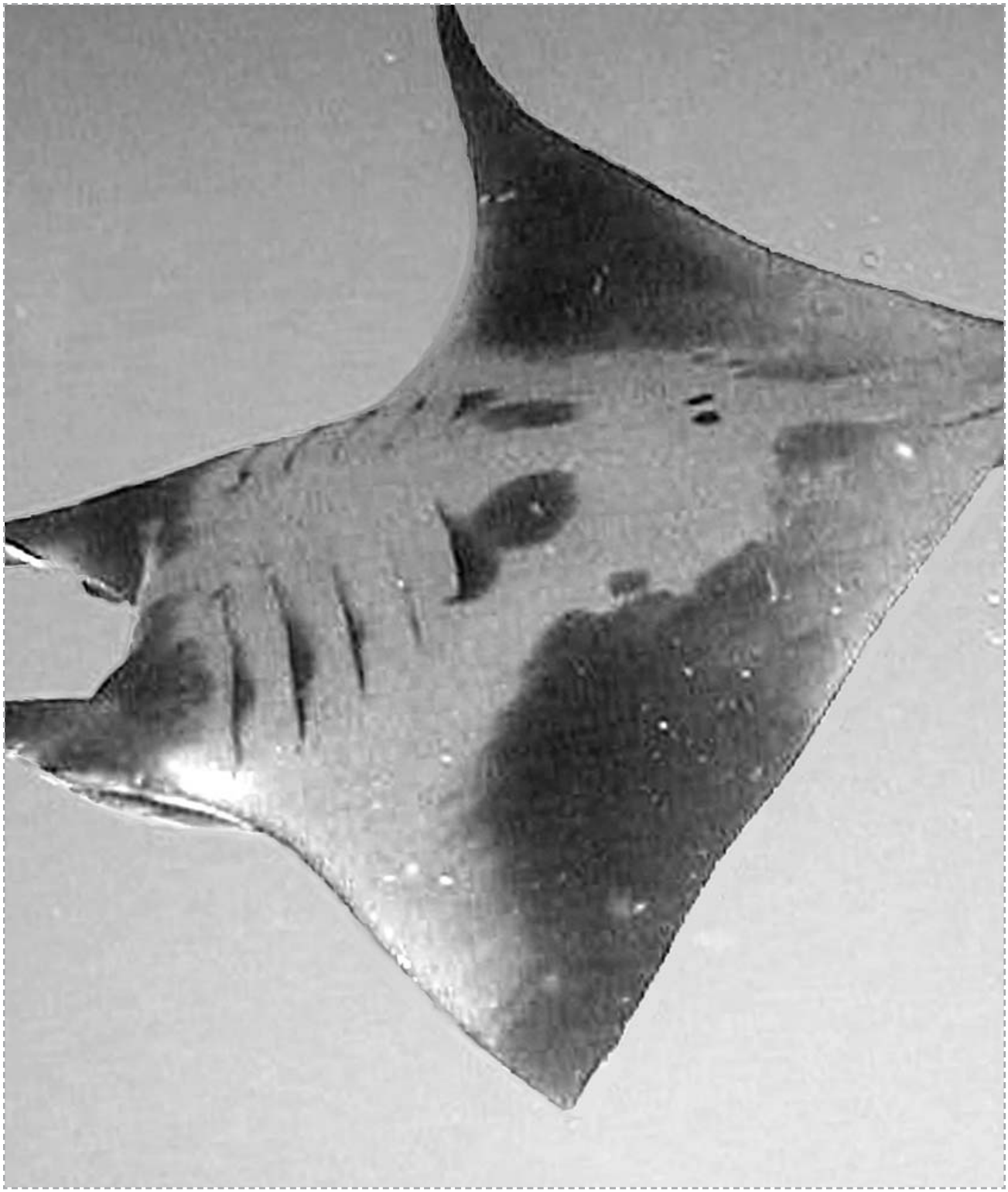
The Manta Network's *Indo-Pacific Manta Migration Study* Web page

Manta Pacific Research Foundation's *Kona Ray Manta ID Catalog* Web site

ReefQuest Centre for Shark Research's *Manta Ray (Manta birostris) FAQ* Web page

Note: Links to all Web resources can be found at www.immersionpresents.org/gulf/links.html.

Manta Ray Spot Pattern 1



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Manta Ray Spot Pattern 2

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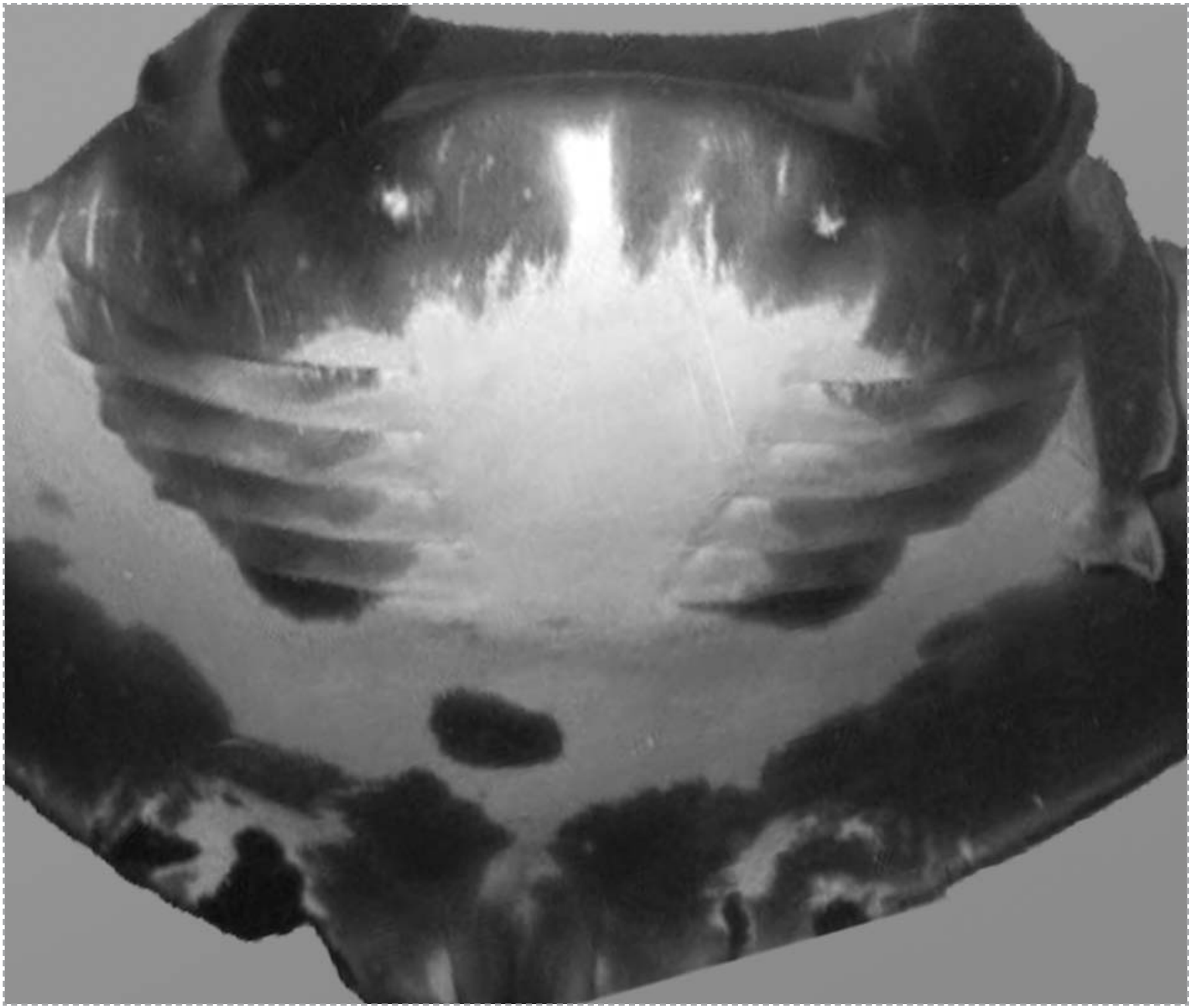
Manta Ray Spot Pattern 3



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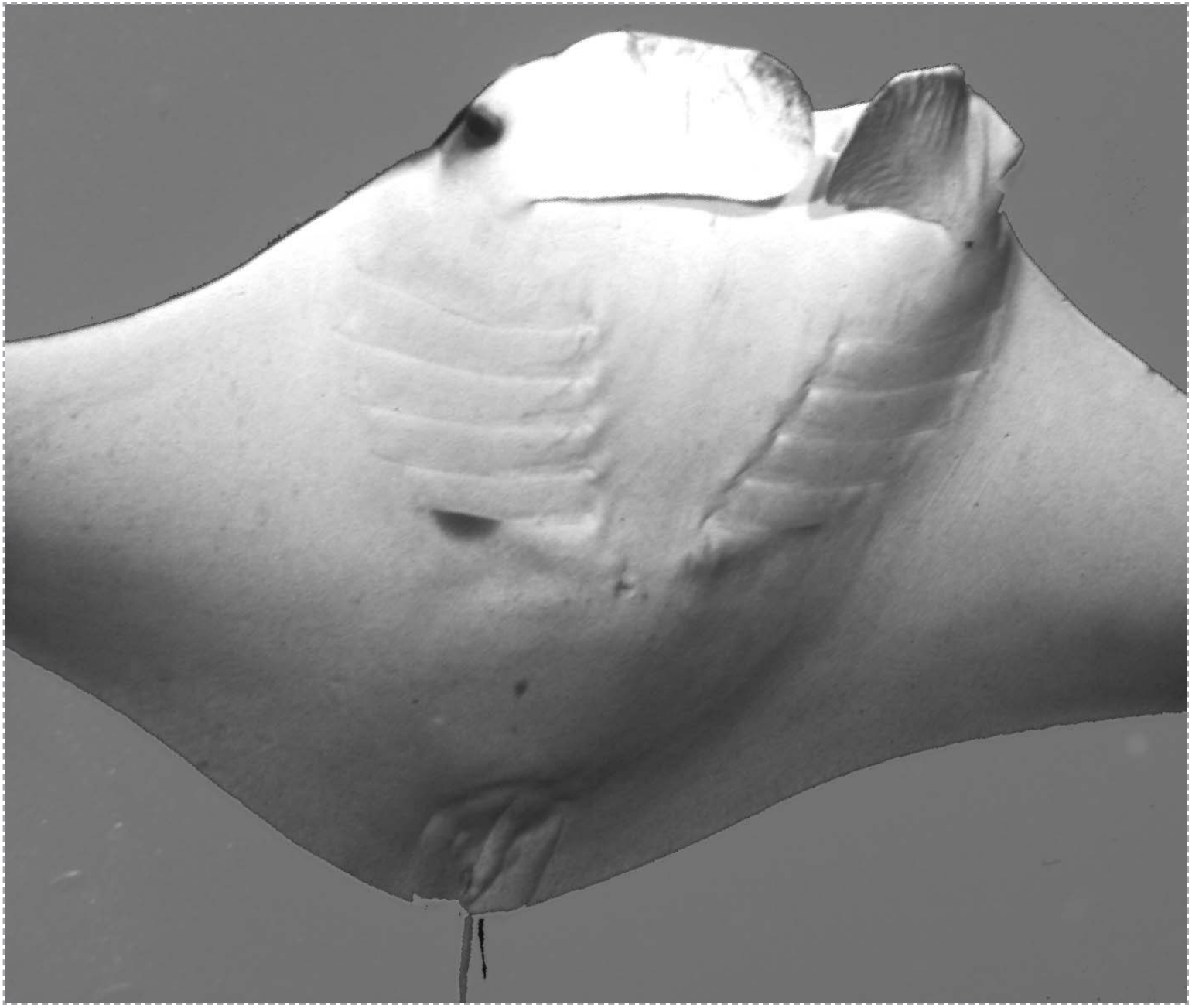
Manta Ray Spot Pattern 4



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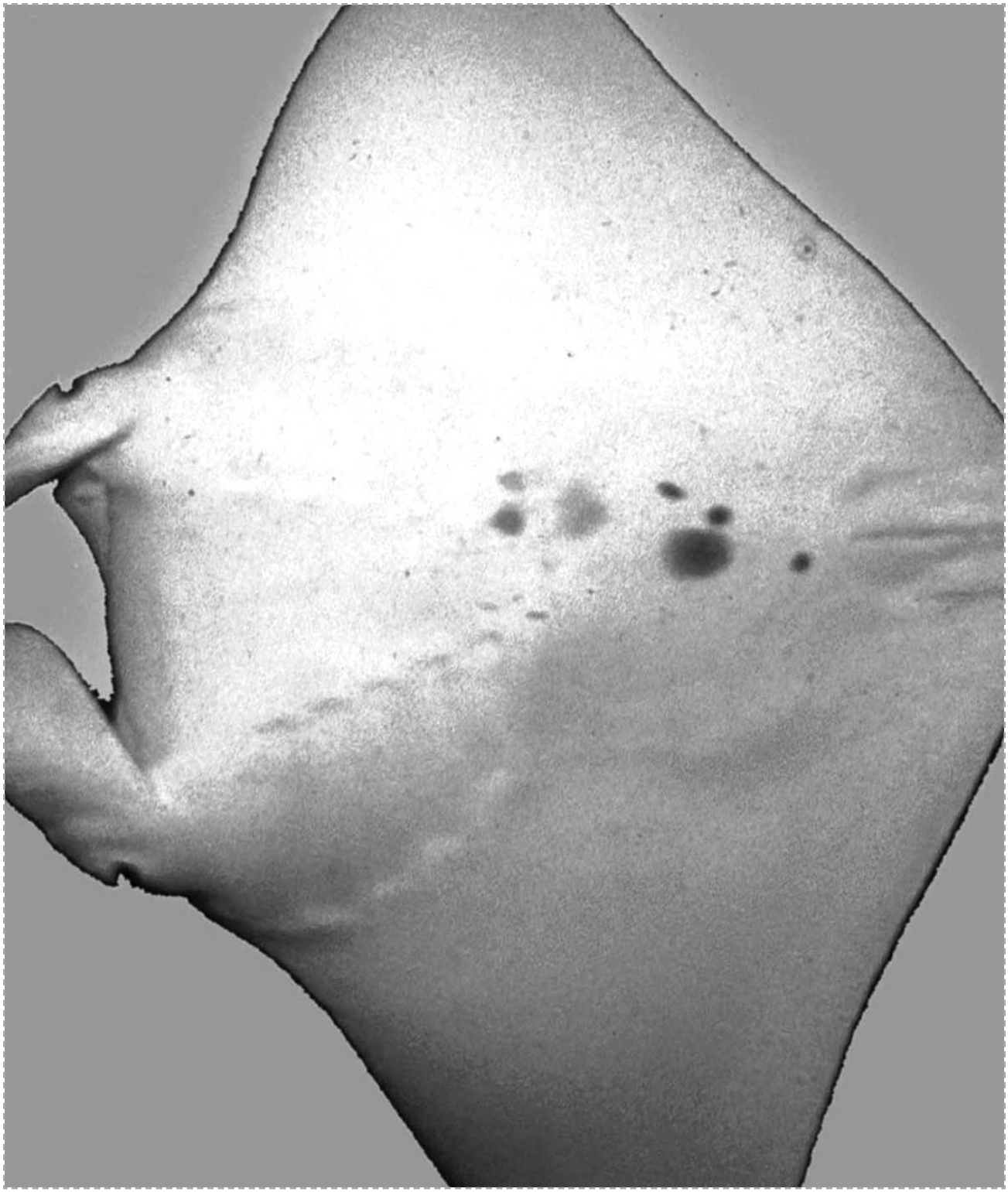
Manta Ray Spot Pattern 5



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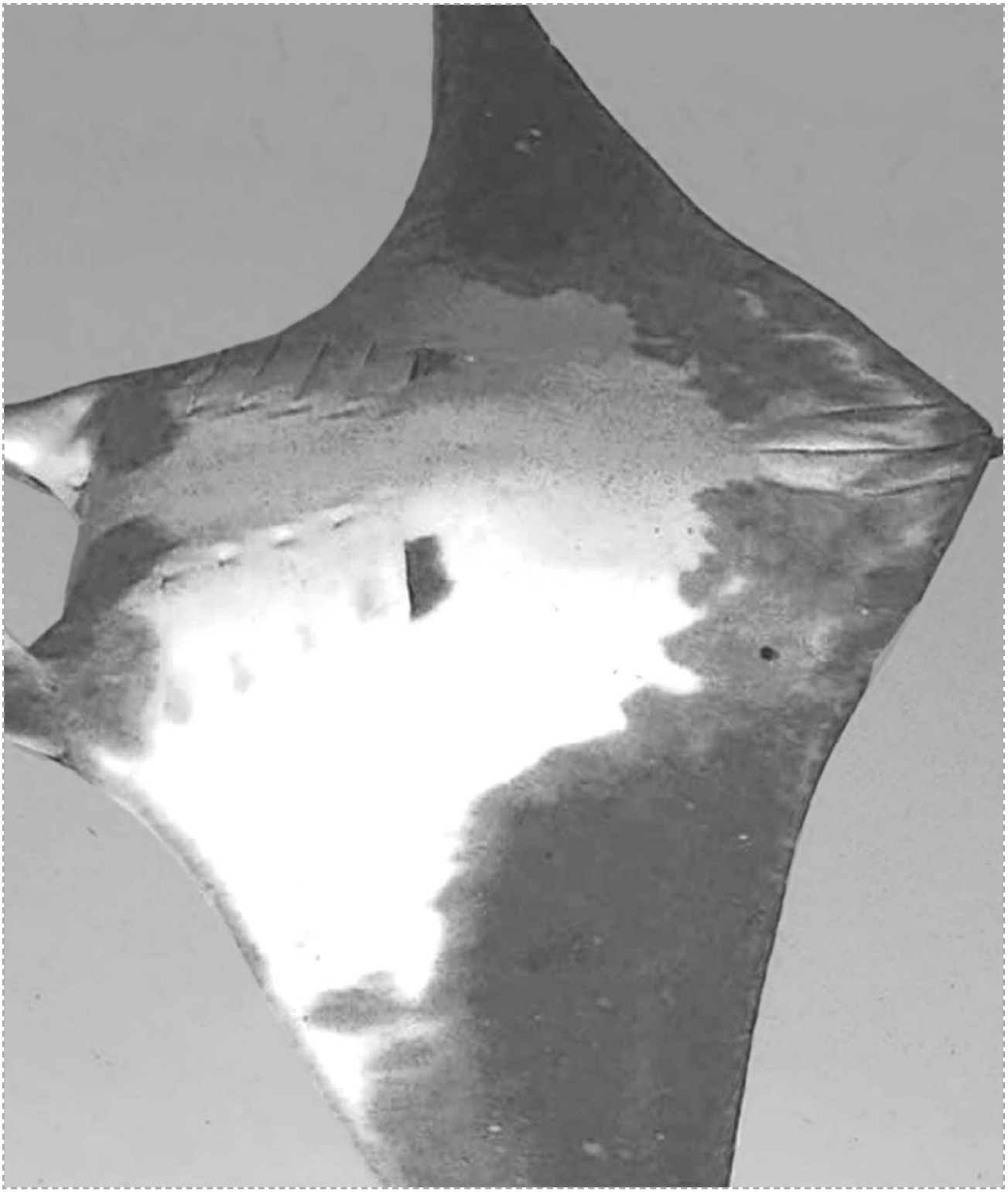
Manta Ray Spot Pattern 6



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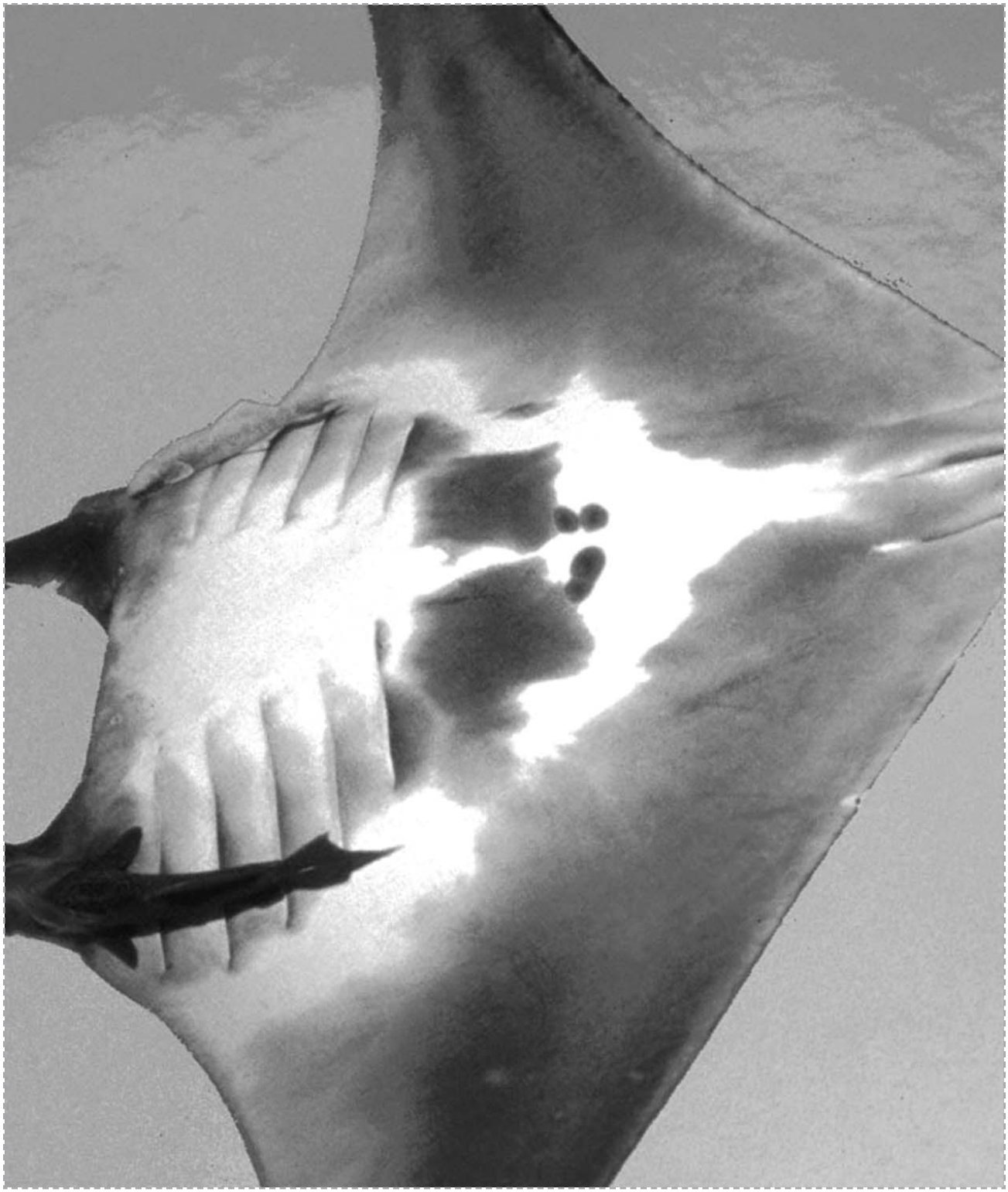
Manta Ray Spot Pattern 7



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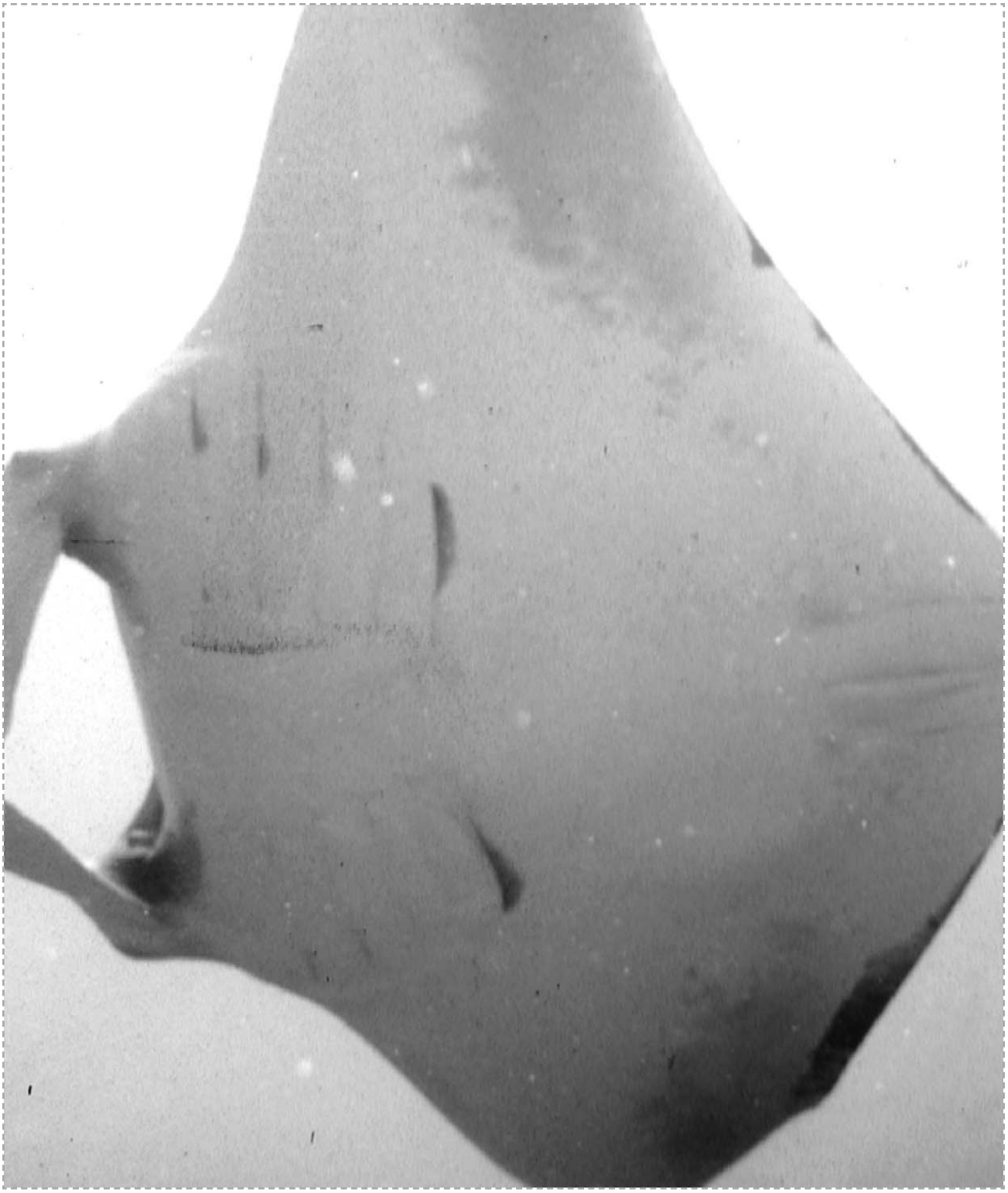
Manta Ray Spot Pattern 8



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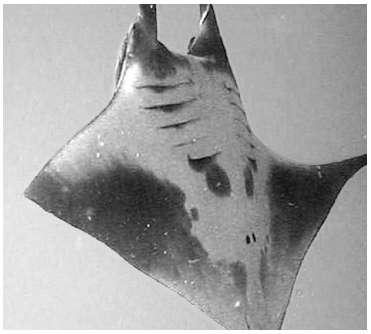
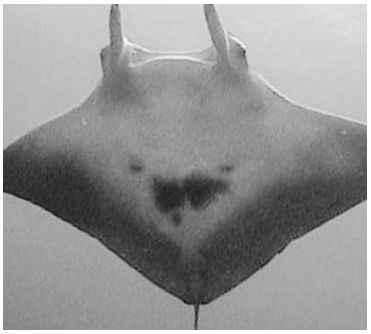
Manta Ray Spot Patterns Answer Key

Manta Ray Spot Pattern 1



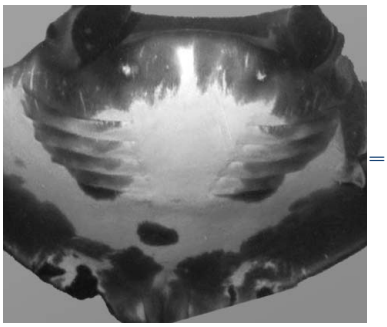
= Manta 1

Manta Ray Spot Pattern 2



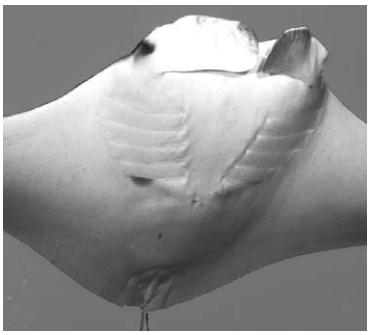
= Manta 2

Manta Ray Spot Pattern 3



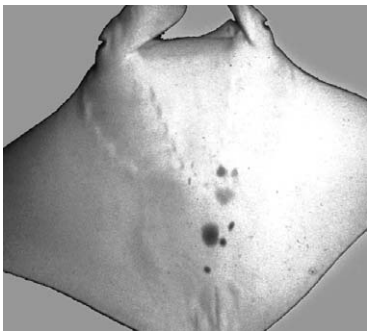
= Manta 4

Manta Ray Spot Pattern 4



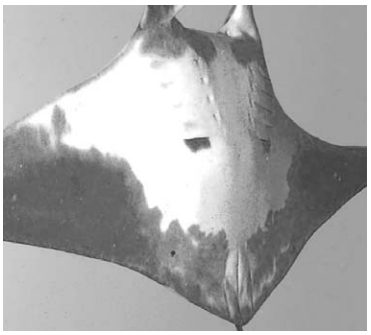
= Manta 5

Manta Ray Spot Pattern 5



= Manta 6

Manta Ray Spot Pattern 6

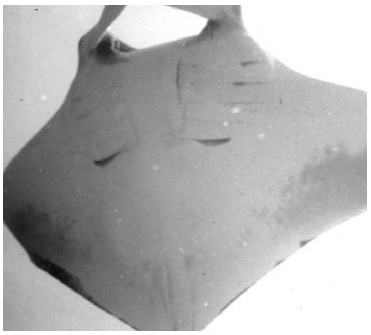


= Manta 8

Manta Ray Spot Pattern 7

= not in Manta Ray Photo Catalog

Manta Ray Spot Pattern 8



= not in Manta Ray Photo Catalog